Lab 8

Lab 8 will be done over the whole semester in three parts as follows.

(1) Plant Build and Verification(Due March 3-6th: Dropbox March 6th*)

For this part of the lab, you will build the circuit in Fig 1. You will need the following parts:
The board has the following components:
-A simple solderless breadboard.
-(4) LM741CN op-amps
-RESISTORS: (5) 10 k, (2) 4.7 k, (1) 74k, (1) 1 k
-Caps: (2) 0.01 microF

This circuit has three outputs labeled on the schematic as V_{HP}, V_{LP} and V_{BP} which are high pass, low pass and bandpass outputs respectively. In this lab we will only be concerned with V_{BP}, which has the transfer function

$$V_{BP} = \frac{s\omega_o}{s^2 + 3\mu_o\omega_o + \omega_o^2}$$

where

$$\mu_o = \frac{R4}{R3 + R4}$$

$$\omega_o = \frac{1}{R2C}$$

You job for part (1) is to build this circuit and verify that it behaves properly. This means that you should:

-Submit Bode Plots of the transfer functionV_{BP}.
-Generate an *experimental* Bode plant of the actual plant.
-Convince us that the results are close enough that your circuit is operating correctly

(2) Compensator Design (PDR) (Due April 10th)

In this part of Lab 8 you will design a compensator. You don't have to build anything. The goal of this compensator as Harry said is to achieve "*a "flat" closed loop frequency response from around 100 Hz to around 10 kHz. "Flat" means that the closed loop gain must stay within ± 3 dB between the 3 dB–down frequencies of 100 Hz and 10 kHz."* See the closed loop Bode plot on the course website (http://ecee.colorado.edu/~ecen4638/).
Other specs include:

-GM of 10 dB
-PM of at least 40 degrees

For the second part of Lab 8 you should convince us and (youreself!) that your compensator will achieve these characteristics and is physically realizable. You should do this by:

-Presenting the full open loop and closed loop transfer functions
-Generating Bode plots in Matlab of both open loop and closed loop transfer functions

-A root locus plot
-A schematic of the full circuit, highlighting where the original plant is and where your compensator is.
-A list of physically realizable components needed to implement it.
-A discussion of all this

(3) Compensator Build and Verification (FDR) (Due April 25th- 29th: Dropbox May 1)

For this part, you will build and implement your compensator. The main here is to demonstrate that it works as it should and meets the specs you designed to in part (2). In you final report, you should compare how the physical system behaves to how your PDR said it would behave in part 2. How close to the design goals did you actually come? If you can't get there, why not?

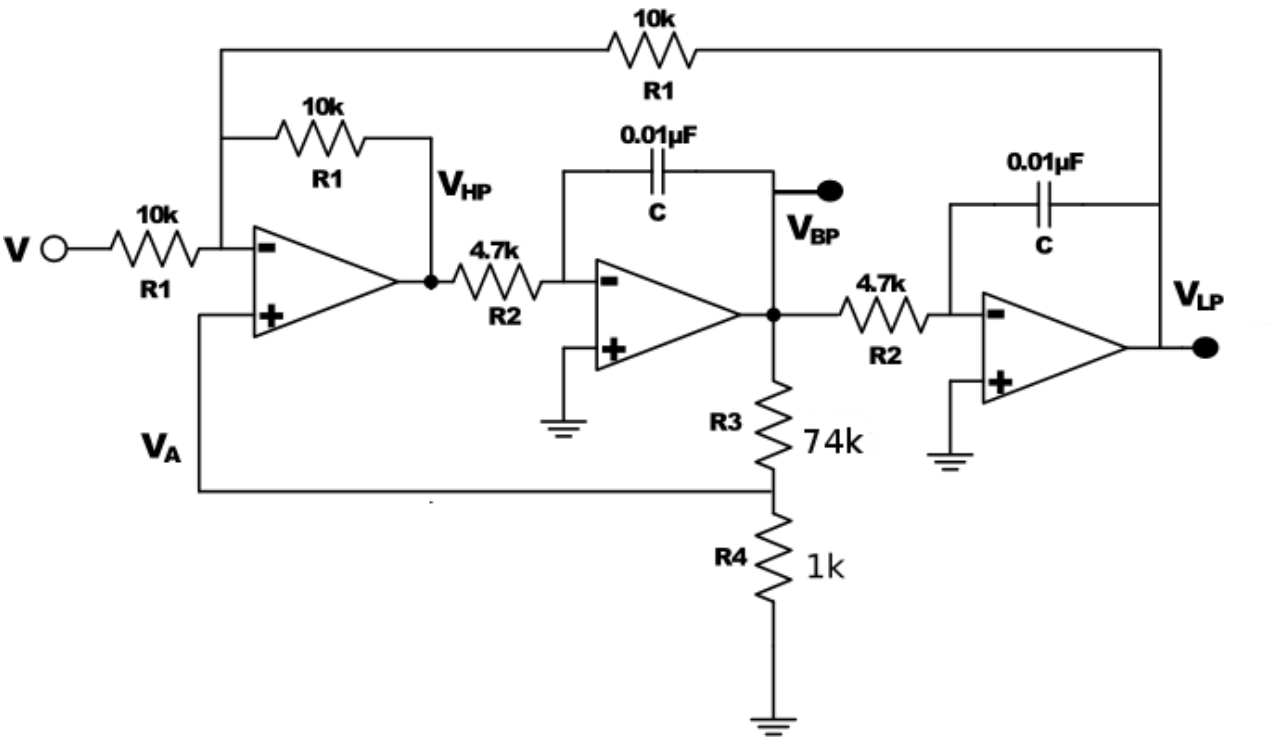

Fig 1

*A note about due dates. For parts (1) & (3) you both physical items to *show* us, and things to write. The physical part is due when you come to class that week. The written part is due on the Dropbox date, which is always after the physical due date. For part (2), you are just submitting your design so it's just due on the Dropbox date.